Current Directions in Learning Technology Standards

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IEEE Learning Technology Standards Committee
▸ Why standards?
▸ The IEEE standards process
▸ Current IEEE LTSC projects
Why Standards?

- **Standards Solve Market Problems**
  - Interoperability – common interpretation of data
    - Lowers costs of product development & integration
    - Enables supply chains to develop
    - Facilitates competition and grows markets
    - Reduces vendor lock-in (third-party & after-market components)
    - Lowers barriers to entry – plug-and-play
  - Quality & Product Category Standards
    - Define best practices
    - Improve reliability, consistency, quality (saving money!)
    - Engender trust (hence willingness to buy)
  - **Adoption is the only metric of success**
How Standards Proliferate:
(See: A/C chargers, character encodings, instant messaging, etc)

**Situation:**
There are 14 competing standards.

14?! Ridiculous!
We need to develop one universal standard that covers everyone’s use cases.

Soon:

**Situation:**
There are 15 competing standards.

https://xkcd.com/927/
You thought the cartoon was a joke?

IEEE Standard for Learning Technology—Data Model for Reusable Competency Definitions

IMS Reusable Definition of Competency or Educational Objective - Information Model

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Learning Technology Standards Have a Long History

- Aviation Industry CBT Committee (AICC) (1988)
- ARIADNE (EU Project) (1996)
- US Postsecondary Educational Standards Committee (PESC) (1997)
- W3C MathML Group (released 1998) and OpenMath (released 2000)

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Some Current Learning Technology Standards

- SCORM (a reference model)
  - Includes IMS Content Packaging, LOM, AICC CMI, and IEEE protocol standards

- Competency and credential standards
  - RDCEO, inLOC, LIP, HR-XML, MedBiquitous. Each serves a different market.

- Expanding LMS capabilities
  - IMS Learning Tools Interoperability

- Content metadata
  - LOM, LRMI, schema.org

- Learning analytics & data exchange in a distributed architecture
  - xAPI, IMS Caliper
Standards Assume a Model of the Marketplace: SCORM and the Enterprise Training Supply Chain
Standards Assume a Model of the Marketplace: IMS Global and the Higher Education Supply Chain
Learning Portability: Fundamental Changes are Afoot

**Yesterday**
- Until recently, content was stored, managed, and delivered via an LMS silo
- Schools, teachers and trainers could assume that they were the learner’s sole source
- Data was gathered for human interpretation, e.g. in daily reports and transcripts
- The principal type of learning activity involved flipping through browser pages
- Online assessment limited to quizzes
- Publishers depend on teacher feedback about their products

**Today**
- An increasing amount of content is cloud- or app-based. Data is distributed.
- Students today work simultaneously with multiple institutions and on-line providers
- AI-enhanced products will benefit from a wide range of historical and real-time data
- The range of technologies and activities is broad and getting much broader
- Continuous collection and analysis of lots of learner activity data by multiple stakeholders
- Publishers are also monitoring learner activity

While SCORM and other standards from that era stressed content portability across LMSs, today’s market issue is “learning portability”
The IEEE Standards Development Process

Community, Consensus, Clarity
Institute of Electrical and Electronic Engineers

- The world's largest technical professional organization for the advancement of technology
- 420,000+ Members (majority not in US)
- Professional Association
  - Publications, Conferences, Member Services
  - Standards
- Organized into societies, councils, and the IEEE Standards Association (IEEE-SA)
- IEEE-SA
  - Over 7000 individual and 200 Corporate Members
  - Offices in US, Asia (China / India), Europe
  - 2,000+ standards + other consensus products
IEEE-SA Principles*

▸ Due process
  - Follow highly visible procedures
  - Set at the IEEE-SA, Sponsor, and Working Group level
  - Process is transparent

▸ Openness
  - All interested parties can actively participate

▸ Consensus
  - A clearly defined percentage required for approval

▸ Balance
  - All interested parties are represented
  - No single party has an overwhelming influence

▸ Right of appeal
  - Anyone can appeal any decision at any point

* https://standards.ieee.org/develop/govern.html
How Standards are Made

- Other SDOs produce standards using procedures that may or may not follow the same principles.
- *De facto* standards may arise from proprietary Intellectual Property (IP) and be controlled by a single entity.

After Robby Robson, 2017
### Most Relevant International Standards Development Organizations for Learning, Education & Training

<table>
<thead>
<tr>
<th>SDO</th>
<th>Type</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dublin Core Metadata Initiative</td>
<td>Metadata (Education part)</td>
<td>Metadata, includes educational elements</td>
</tr>
<tr>
<td>IEEE Standards association</td>
<td>Formal SDO</td>
<td>General interoperability standards. Industry, academia, and government. Includes the Learning Technology Standards Committee, but there are other relevant standards activities.</td>
</tr>
<tr>
<td>IMS Global Learning Consortium</td>
<td>Industry Consortium</td>
<td>General interoperability standards. Participants tend to be connected with formal education.</td>
</tr>
<tr>
<td>ISO/IEC JTC1 SC36</td>
<td>Formal SDO</td>
<td>General interoperability standards. Participation from national bodies.</td>
</tr>
<tr>
<td>W3C</td>
<td>Open Consortium</td>
<td>Web / Semantic Web – also used for its communities structure</td>
</tr>
<tr>
<td>Schema.org</td>
<td>Not an SDO but relevant</td>
<td>Microdata for describing resources</td>
</tr>
<tr>
<td>HR Open</td>
<td>Industry Consortium</td>
<td>Applicant Tracking Systems, Background checks, HR systems, etc.</td>
</tr>
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</table>
Types of IEEE Standards Projects

▸ A **standard**, containing mandatory requirements,
▸ A **recommended practice**, outlining preferred procedures, or
▸ A **guide**, offering suggestions for working with a technology.

▸ Examples:
  - Lists of terms, definitions, or symbols
  - Measurement/tests of the performance of any device, apparatus, system
  - Characteristics, performance, and safety requirements
  - Recommendations reflecting state-of-the-art in the application of principles

▸ Key question
  - Is the standard necessary for market growth, stability, and/or innovation?
### What Can be Standardized?

<table>
<thead>
<tr>
<th>PHYSICAL STANDARDS</th>
<th>DATA STANDARDS</th>
<th>PROCESS STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Weights and measures</td>
<td>• Formats &amp; representations</td>
<td>• Governance and reporting</td>
</tr>
<tr>
<td>• Sizes and shapes</td>
<td>• Semantics &amp; interpretation</td>
<td>• Process management</td>
</tr>
<tr>
<td>• Stresses and tolerances</td>
<td>• Persistence and availability</td>
<td>• Quality control &amp; assurance</td>
</tr>
<tr>
<td>• Allocation of spectrum</td>
<td>• Metadata and curation</td>
<td>• Safety &amp; legal conformance</td>
</tr>
<tr>
<td>• What wires do what</td>
<td>• Privacy and security</td>
<td>• Ethics and behaviors</td>
</tr>
</tbody>
</table>

A given standard can involve aspects of two or even all three categories.
The IEEE Standards Association’s Process

**Idea (from Study Group, TAG, WG, ...)** → **PAR** → **Sponsor (LTSC)** → **IEEE-SA New Standards Committee “NesCom”** → **LTSC Working Group** → **Draft Standard**

**LTSC** → **IEEE-SA Standards Review Committee “RevCom”** → **IEEE-SA Standards Board** → **Publication**

Balloting Committee Review & Comment
Publishing a Standard is Just the Beginning

**Only the market can establish a standard**

**Pre-standards Activities**
- Principles
- Requirements
- Early Specs
- Prototypes

**Standard Writing**
- Compromises
- Consensus
- Champions
- Prototypes

**Initial Implementations**
- Publication
- PR
- First Products

**Rude Awakening**
- User feedback
- Revisions

**Adoption-Stabilization**
- Test Suites
- Products
- Conformance
- Buyer require compliance

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Barriers – How Consensus Standards Fail

- Too complex to implement affordably
- Too ambiguous to implement consistently
- Does not result in the needed level of interoperability
- Lack of promotion to help the marketplace understand its value
- Inelegant or outdated choices in technical implementation
- Lack of support for implementers (docs, help desk, conformance test, ...)
- Competition with alternative standards, e.g., proprietary solutions
- Bad timing, e.g., technical breakthroughs or changes in market structure
Current Standards Projects at the LTSC

- SCORM Renewal, 1484.11.3 ..., Andy Johnson
- Student Data Governance, P7004, Marsali Hancock
- AR Learning Experience Model, P1589, Fridolin Wild
- Mobile Learning Platforms, P7919.1, Robby Robson
- Reusable Competency Definitions, P1484.20.1,
- Adaptive Instructional Systems, P2247.1
- xAPI, P9274.1.1
P9274.1.1 xAPI

- xAPI 1.0.3 base standard
- Recommended practice standard for implementers
- Future
  - xAPI profiles standard
  - Individual xAPI profiles
  - xAPI 2.0
- Jono Poltrack, Chair. [http://sites.ieee.org/sagroups-9274-1-1/](http://sites.ieee.org/sagroups-9274-1-1/)
- Meeting this afternoon at IDA
P 1484.20.1 Reusable Competency Definitions

- Revision of a 10-year-old standard with limited impact, but the time is ripe.
- Based on the common elements identified in the Ecosystem Mapping Project’s crosswalk of existing standards for representing competencies and competency frameworks.
- Chair, Jim Goodell
- Kickoff meeting, Monday, September 10
- [http://sites.ieee.org/sagroups-1484-20-1/](http://sites.ieee.org/sagroups-1484-20-1/)
P2247.1 – Standard for the Classification of AISs

- Enable consumers to make comparisons among current and future products
- Inform purchasing and deployment decisions
- Serve as a reference for subsequent technical standards for data exchange
- Promote “ethically aligned design” for the use of AI

Define:
- The operation and common features of AISs, and the way they use AI
- Categories of AISs
- Standardized component definitions
- Levels of functionality and adaptation “power”
- Design approach & methods used

Bob Sottilare, Chair. Bi-weekly meetings. Silicon Valley Conference, October 30-31

http://sites.ieee.org/sagroups-2247-1/
ICICLE – The IEEE Industry Connections Industry Consortium on Learning Engineering

- Is there a need for a new engineering discipline to deal with the automation of education and training?
- Conference, May 2019, Arlington, VA
- Special Session at I/ITSEC 2018 – Forming Military Training chapter of ICICLE
- Shelly Blake-Plock, Chair.
- Meetings monthly. www.ieeeicicle.org
For more information:

IEEE LTSC  
www.ieee-ltsc.org

ICICLE  
www.ieeeicicle.org

IEEE Standards U.  
http://www.standardsuniversity.com

Standards Lifecycle  
http://standards.ieee.org/develop/index.html

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Robson & Barr: The New Wave of Training Technology Standards

I/ITSEC 2018